DOCUMENT RESUME

ED 248 885 IR 011 348

TITLE	Teaching and Learning with Computers. Position Paper.
INSTITUTION	Teacher Education Conference Board, Albany, NY.
PUB DATE	Apr 84
NOTE	22p.
PUB TYPE	Guides - Non-Classroom Use (055) -- Information Analyses (070) -- Viewpoints (120)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	Cognitive Processes; *Computer Assisted Instruction; *Computer Literacy; Computer Managed Instruction; Computer Simulation; Computer Software; Elementary Secondary Education; *Inservice Teacher Education; *Microcomputers; Policy Formation; School Districts
IDENTIFIERS	Computer Games; *Computer Uses in Education

ABSTRACT

This booklet examines the current instructional uses of computers, their demands on teachers and teacher trainers, and the measures required to further promote their use. Five principal educational computer uses are addressed: (1) learning from computers in drill and practice and tutorial programs; (2) learning with computers using simulations and games; (3) learning about computers and their operation, or "computer literacy"; (4) promoting the ability to think through discovery, self-correction, and the combination of simple structures into more complex ones; and (5) managing learning with computers. It is recommended that educators develop school district computer guidelines and increase personal knowledge of the uses of computers through self-study, school workshops, and formal course work. A glossary, 7-item reference list, and a bibliography of 16 books, 10 journals, and 13 selected journal articles are included. (LMM)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED248885

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

✗ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

POSITION PAPER POSITION PAPER POSITION PAPER

OFFICERS OF THE BOARD

President, Paul LeClerc
Vice-Pres., Toni Cortese
Secretary, John Van Buren
Treasurer, Murray Schneider

REPRESENTATIVES OF CONSTITUENT ORGANIZATIONS:

Confederated Organizations of Teacher Education (COTE)
New York State American Association of Colleges for Teacher Education

F. Elizabeth Moody
John Van Buren

New York State Association of Teacher Educators

James F. Collins

Council of University Deans

Burton Blatt
Robert H. Koff
Paul LeClerc
Michael Timpane

New York State Federation of School Administrators

Simpson Sasserath
Murray Schneider

New York State United Teachers

Toni Cortese
Joanne Hannon
Thomas Y. Hobart, Jr.
Harvey Inventasch
Kathleen McKeon
Leonard Motisi
Gloria Weinman
Patricia Whitney

STAFF CONSULTANT

James J. Kiepper

This is the third in a series of occasional papers published by the Teacher Education Conference Board on topics of timeliness and relevance to those who teach in our schools. Like its predecessors — "Teaching As A Profession: Toward The Promotion And Support Of Competence" (1980) and "The Effective Teacher" (1981) — "Teaching And Learning With Computers" aims to improve schooling by placing in the hands of our practitioners a combination of information and its interpretation that are of broad applicability in today's classrooms.

While the impact of computer technology in contemporary American education remains to be fully assessed, the presence of such technology in the lives of our children and their teachers is pervasive. It is the Conference Board's hope that "Teaching And Learning With Computers" will serve as an important guide to those interested in using the computer as a means for enhancing the teaching/learning process.

Paul LeClerc
President
April, 1984

The Teacher Education Conference Board is a confederation of major New York State organizations devoted to the preparation of effective teachers. These groups joined together in 1972 for the purpose of speaking with a unified voice in developing more effective professional education through the initiation of policy statements. The objective of the Conference Board is to exercise leadership in teacher education and certification in New York State.

Contents

Page

Models of Computers 3
- Learning From Computers 4
- Learning With Computers 6
- Learning About Computers 8
- Learning About Thinking With Computers 9
- Managing Learning With Computers 10

Action Recommendations 11
- Conclusion 13

Glossary 15

Bibliography
- Books 16
- Journals 17
- Selected Journal Articles 17
- References 18

Teaching and Learning With Computers

Computers, especially microcomputers, have moved into practically every aspect of modern life. Banking, publishing, engineering, business, law, and medicine have all been altered by the availability of relatively inexpensive microprocessors. Innovation has come at a somewhat slower pace in education. This is due to such factors as funding problems, the generally undistinguished results of using large computers in education, and, possibly, a greater resistance to change. Microcomputers are becoming increasingly common in schools, however, and they are expected to become even more available in the near future. In just one recent year, the number of schools with microcomputers increased by over 60 percent, the fastest growth being in smaller districts, thereby lessening the gap with the larger ones.[1]

This growth, and the demands that it may place on schools, lead to three important questions for educators:

1. What are some of the ways in which microcomputers are currently being used in schools?
2. What demands will the increased use of microcomputers place on teachers and teacher training?
3. What are some steps that educators might take to promote the use of computers in their educational situations?

Models of Computer Use

One analysis identifies three main roles for the computer in the schools: as a "tutor" (a machine that teaches), as a "tool" (a machine that can do things for you), and as a "tutee" (a machine that can be taught).[2] Another conceptualization differentiates among learning *from* the computer, learning *with* the computer, and learning *about* the computer.[3] From these models, five principal uses of the computer in the educational process can be recognized:

1. Learning FROM computers
2. Learning WITH computers
3. Learning ABOUT computers
4. Learning ABOUT THINKING with computers
5. MANAGING learning with computers

It is especially important to notice that the word "learning" occurs in each of these uses. This learning can take place in schools, but also in a variety of ther environments, such as the home or the workplace.

To bring about computer-based learning in the school setting, three components must be brought together: the two major aspects of computer systems, *i.e.*, (1) the hardware or physical components of the computer and (2) the software, the programs that are utilized with the hardware, along with a third component, (3) teacher training. Effective learning depends on all three of these components, though not necessarily with equal stress. Some computer-based learning situations may call for a heavier reliance on one or two of the components, with a correspondingly smaller demand for the remaining one.

Learning From Computers

There are times when the computer can relieve the teacher of certain duties or perform the functions formerly served by other instructional materials. The two most common modes in which students can learn *from* computers are (1) drill and practice and (2) tutorial. In drill and practice, it is assumed that the student has already been taught some skill or idea, and the computer simply provides a large number of relevant practice problems for the student to work on. In the tutorial mode, it is not assumed that the student has already been taught the particular topic, so the computer serves as the dispenser of information and may include practice questions on the topic as the tutorial lesson proceeds.

Drill and practice programs can be extremely useful in those situations where students need extra practice to develop a particular skill, but the teacher does not have the time to work with each one individually. The motivational effect of using these programs can be quite strong, especially at first, because they provide the student with something quite different from the traditional workbook.

The effectiveness of drill and practice programs is dependent upon the variety of responses and degree of interaction with the user that are built into them. In many programs which generate problems to give practice, the only responses given are "correct, good job" and "no, try again." No attempt is made in the program to vary the responses, or to make use of students' incorrect answers to diagnose their difficulties in solving the problems, or even to provide a second chance on the same problem with an appropriate hint. The

utilization of student responses is a critical feature of good drill and practice programs. A poorly designed program that merely gives the response, "wrong, try again," when the student makes an error is not really using the power of the computer, but merely turning it into an "electronic workbook."

That the computer might be employed as an individual tutor was envisioned as early as 1966 by one of the pioneers in the educational use of computers:

> One can predict that in a few more years millions of school children will have access to what Philip of Macedon's son Alexander enjoyed as a royal prerogative: the personal services of a tutor as well informed and responsive as Aristotle[4]

Clearly, this did not come to pass "in a few more years." The missing ingredient in this forecast was the critical importance in the one-to-one tutorial approach of the tutor's skill and knowledge. Just as few human tutors have been as skilled in teaching and as knowledgeable about subject matter as Aristotle, a very small percentage of the tutorial computer programs that have thus far been developed exhibit the kind of "skill" that is needed to make this teaching approach as effective as it can and should be.

Most tutorial software presents the information in an extremely linear and non-individualized manner, aimed at too large and diverse an intended audience. Such programs are not really designed to interact with the user and to modify continually the subsequent presentation on the basis of the student's earlier responses. This is what a good human tutor needs to do in order to make a one-to-one tutorial approach effective, and it is what a computer tutorial program must do as well.

For learning *from* the computer the two most important of the three components are the hardware and the software. Low quality hardware will not allow good software to be utilized, and a powerful machine may be wasted if effective software is not available for the purpose intended. Teacher training, while definitely necessary, is not critical for this type of computer utilization, since the program already incorporates the necessary teaching or drill and practice, therefore making additional programming unnecessary. Teachers must, however, be effective diagnosticians, especially if the programs are to be used for remediation, and they must know where and when to make use of the programs within the curriculum.

There are other situations in which the computer does not perform didactically in place of a teacher, but instead serves a teacher as a sophisticated instructional aid, providing students experiences in applying what they have learned that otherwise would have to be gained either vicariously through some less effective device or directly in an actual situation. The two categories of instructional technique that exemplify learning *with* computers are (1) simulations and (2) games. With and without computers, simulations have been used for some time in military, business, and governmental settings. Recently, they have become increasingly popular in education, especially in teaching science, mathematics, and the social sciences.

A good example of a science simulation is one that was developed as an ecological simulation for grades four through six.[5] In this simulation, the student plays the role of a particular type of fish that lives in a lake and must make decisions about how to react when various situational changes occur. These decisions are considered by the computer program, which lets the student know whether or not the response was an appropriate one and then introduces another change into the situation.

A good simulation permits students to make mistakes for which the consequences are non-threatening and allows them to exercise some control over the learning process. Too often our educational situations are "right answer only," where students are strongly encouraged not to make mistakes. If schooling is really intended to mirror the real world, however, students must be given more opportunities to make mistakes and to learn from them. Learning why something is wrong and then being able to repeat the process with this insight as a guide is often a stronger learning experience than just trying to get the correct answer from facts that have been memorized.

A simulation allows the student to try different approaches in response to a given situation without having to fear the consequences of an incorrect action. Simulations let the student become a decision maker rather than simply a receiver of information, and because this type of control is intrinsically motivating to the student, it helps make the simulation an effective learning tool.

A computer game differs from a simulation in that the game need not model a real world situation, and the learning is usually acquired

indirectly, as the student attempts to develop a winning strategy in the game. A good example of a computer learning game is one in which the students objective is to find a small cartoon-type character after it has been randomly hidden somewhere on the screen.[6] The student uses numbers representing different positions to guess its location and, when incorrect, is given a hint as to which direction to move. The student then uses this information in a second trial, and each incorrect response elicits a new hint until the character is found. In this game, the student implicitly learns how to represent positon on a line or two-dimensional grid numerically.

While learning *with* computers through simulations and games may represent a better and more effective use of the computer's capabilities as an educational tool than learning *from* it does, these approaches do have limitations. In order for a simulation to be effective, it must present an accurate model of some process or situation. There are suitable models in many topics in science, mathematics and the social sciences, but the amount of time and money needed to develop them is very great and, hence, not as many simulations and games are available as are drill and practice or tutorial programs.

Furthermore, students must be cautioned that they are working with a model, not the real situation, and that a simulation cannot account for all the effects that can occur in the real-world situation. Finally, simulations should not replace real-life experiences, but should enhance and augment them. The way to learn ecology is actually to do ecology, but multiple ecological experiences may not be available to all students in school. Ecological simulations can therefore be used to give students the opportunity to experience situations that they would not be able to experience in real life.

Simulation and game programs will not replace classroom teachers. Detailed teachers' guides for developing extended lessons around particular computer simulations make it clear that the programs themselves cannot, in most cases, stand alone.

For learning *with* the computer, the software is the most important component, next in importance is the hardware, and least important, although still necessary, is teacher training. Software is the most important because even the most sophisticated machine must have well-prepared, realistic, and motivating simulations and games to go with it. While special capabilities such as high-resolution color, graphics, and sound can greatly enhance a

simulation, even machines that do not have all of these features can deliver good simulations, if the programs are well written. As for teacher training, again the teacher must be familiar with the program and its appropriate place in the curriculum, but need not have detailed knowledge of programming and computer hardware.

Learning About Computers

The term, "computer literacy," refers to a beginning awareness of what a computer system is and the components that make it up, the languages that are used with computers, their basic operation, their impact on our society in general and on particular occupations, both now and in the near future, and an introduction to actual programming of a typical computer. Once computer literacy is achieved, several avenues of further computer learning are available toward what might be properly called "computer competency."

A major problem that teachers, administrators, and parents must face is the age-old one of deciding what must be removed from an existing curriculum if a new subject is to be added. One of the most popular approaches is to incorporate the computer literacy program into an appropriate subject-area course or sequence, usually in mathematics. In this way, students can learn about the computer as it applied to the ongoing study of the subject matter.

A second approach is the development of a special minicourse on computers, into and out of which groups of students rotate throughout the year. Such minicourses may last anywhere from three weeks to an entire semester and are sometimes special offerings during the summer or after school, so that the regular curriculum does not have to be altered.

In learning about computers, students need not only to become familiar with their functioning, but also with their more typical uses in the world-at-large and the potentialities of microcomputers in the home. Typical commercial applications include scheduling and ticketing transportation, inventorying merchandise, maintaining records, making financial transactions, composing and editing copy, and permitting engineers and designers to view their creative products from various perspectives and refine them accordingly. What the ultimate uses of home microcomputers will be is as yet not clear, but students need to consider their possible applications in maintaining household inventories and financial records, storing recipes and addresses for retrieval, examining income and expense

trends, recording and charting their own physical development and educational progress, and doing their own homework. They need to know how to use the computer for these and other possible domestic functions and to consider the cost effectiveness of such use.

For both computer literacy and competency, the most important factor is the teacher training, followed by the hardware and finally the software as relatively minor components. Unfortunately, the necessity for a qualified teacher may be a serious problem for most school districts in the near future, since few colleges and universities include computer training within their teacher-preparation programs.

Learning About Thinking With Computers

Learning *about thinking* with computers is probably the most unconventional but at the same time perhaps the most powerful, of the five uses presented. In this role, the computer is used to help students develop new patterns of thinking that may assist them in many different learning situations requiring analysis and logic. In accordance with the terminology of Jean Piaget, the computer can be used to make "concrete" many of the "formal" learning situations that students face, thereby permitting the teaching of formal operational level concepts as though they were at the concrete operational level.[7]

Structured thinking involves the dividing of a large problem into smaller ones that can be easily handled individually and then combined to give a solution to the original larger problem. One way of promoting the learning of structured thinking is through the student's interaction with the computer, using a computer language that is itself structured. Such a language allows the writing of a program to solve a relatively complicated problem by breaking it down into smaller and simpler components, constructing "procedures" or sub-programs to deal with each of the components separately, and then combining these sub-programs to produce a total program that solves the problem. Since BASIC was not developed to have this kind of structure, it has been criticized as an inappropriate first language for someone learning about computer programming, especially for children. The LOGO language has been proposed as an alternative.

Central to LOGO is a small triangular image on the display screen of a micro-computer, the position and motion of which is controlled

by the student. As it moves about the screen, it can create a graphical display. Although a simply graphic program may not seem to be "teaching" the student much, it contains, in fact, two very useful and important features. First, the student learns by trying out different possibilities and correcting any mistakes or omissions, instead of simply being told what to do. The importance of allowing students to make decisions that might be wrong and to learn from their mistakes when they occur cannot be overemphasized. The use of the computer in this role allows immediate feedback, permitting students to discover and correct mistakes on their own without the onus of being "found out" and corrected by the teacher. Secondly, the structured nature of LOGO allows the student to combine simply graphical programs into combinations that produce much more complicated and detailed designs, such as the graphic of a house or a spaceship.

For this role of the computer, hardware, software, and teacher training are of essentially equal importance. At the present time, in order to utilize a full LOGO-type system, excellent hardware must be available (e.g., large memories, good graphics, disk storage, etc.). This may involve a much more significant investment than the less elaborate systems that will serve some of the other uses of a microcomputer discussed. Moreover, the software component is equally important, since a school would find itself with a powerful system with nothing to 'run' on it, unless the LOGO (or similar structured language) software were available. Once the system software is purchased, however, no additional software is needed.

For working with such a structured language, not only do teachers need training with computers, but also work in Piagetian developmental psychology and the educational philosophy of allowing and encouraging student exploration. Because this non-standard teacher training is so extremely important, it must be considered on an equal footing with the hardware and software requirements.

Managing Learning With Computers

In contrast with the other roles of the computer in education that have been discussed, the *managerial* use is only indirectly related to student learning. In this role, the computer helps teachers and administrators with much of the paperwork and many of the organizational tasks that often take time away from actual teacher-student interaction.

The computer can be used to keep track of grades and provide desired information about those grades, such as averages and totals. Second, the computer can generate test questions for the class in general and special remedial questions for individual students, based on their particular needs. Third, the computer can keep the attendance record of the students in the teacher's class. On a school-wide level, administrators can compile teachers' reports to produce school and district information. Fourth, the computer can be used for many other administrative duties, such as class scheduling, budgeting, recording the availablility and qualifications of substitute teachers, keeping supply inventories, and performing similar tasks.

Finally, since the computer can be employed for word processing, as well as data management, teachers can compose on it the various handout materials they prepare for classes and revise them year to year directly on a master tape. As students increasingly use this word-processing feature in preparing their compositions and other assignments, it is not difficult to envision the time when these student products will be transmitted directly to the teacher's computer, rather than submitted in "hard copy." The teacher may then also make comments, corrections, and suggestions on the computer for transmission to the students' devices, not inconceivably in an interactive mode.

In the computer's managerial role, either the teacher-training component is the most important and the software is least important, or the reverse is true. If teachers have adequate training, then they can develop a great deal of the software to fit their specific classroom management needs, making commercial software less important. On the other hand, if teachers lack the training to do this, then commercial software for classroom and school-wide management must be purchased. In either case, the software is more important than the hardware, which needs no special capabilities.

Action Recommendations

Two main recommendations, relating to policies and personnel, can be offered educators as their schools expand their use of computers. There are several options for carrying them out, and each school must adopt those which are most appropriate in the local situation.

1. *Develop school district computer guidelines.*
   Each school district needs policy statements or guidelines for computer acquisition and use. The guidelines should take into account:

   a. The possible roles for which the computer system will be used.

   b. The generally mediocre quality of educational software currently available.

   c. The rapidly changing hardware market, which will require that equipment be reviewed frequently to determine whether older hardware should be replaced.

   d. Maintenance budgets, which should be roughly 10 to 20 percent of hardware costs *per year*, especially if the equipment is being heavily used.

   e. The extent of teacher inservice education which will be needed.

Teachers, supervisors, and administrators should all play an active role in helping to formulate guidelines for classroom computer use.

2. *Increase personal knowledge of the uses of computers.*
   Educators can become more familiar with microcomputers and their possible uses through self study, school workshops, and formal course work.

a. *Self study.* A sampling of the many available articles and books on school computer applications is listed in the bibliography. Since there is a diversity of opinion about the most appropriate uses of computers in instruction, educators are well advised to read a variety of authors for a sampling of viewpoints. The major drawback of self study, especially through books, is the speed at which the whole field changes. The publication lag time of books sometimes reduces their content to history, particularly with respect to hardware.

Having a computer at home is, of course, a great advantage in increasing personal knowledge. Teachers should check with local district officials about possible special prices for educators or the loan of a machine during non-peak periods, such as holidays and summer vacations.

b. *School workshops.* A second method by which educators can upgrade their skills is through workshops conducted by school districts or institutions of higher education. Because of time limitations, workshops are generally more suitable for the exploration of single or limited topics than for in-depth study of computer applications. Workshops on those computer roles that do not require a large investment in teacher training, such as learning *from* and *with* computers and *managing* learning with computers would be more appropriate in a short workshop than trying to develop mastery of a language such as LOGO. A workshop does provide an excellent vehicle for starting orientation in computer applications as a basis for a later workshop series or coursework at institutions of higher education.

c. *Coursework.* Institutions of higher education must assume two roles pertaining to the development of training in instructional computer applications. First, pre-service teachers must be brought up to the literacy level of computer use through appropriate coursework at the undergraduate level. This will probably require a course in utilizing the computer both as an educational tool and as a tool for professionals. Specific applications to curricular areas may best be handled through the subject matter fields themselves. Some articles discussing various options are included in the bibliography.

The second role of higher education is to enable teachers inservice to learn how to use computers in instruction and to keep up-to-date as the field advances. Many colleges and universities have expanded their course offerings in computer applications, and some have both degree and certificate programs available for teachers and administrators who may, after a workshop, have begun thinking about, and working with, some applications of micro-computers. These offerings range from beginning literacy courses to specialized courses in subject areas and on topics such as LOGO and interfacing computers with videotape and disk systems. Not every educator will need this level of expertise, but computer-science teachers, computer resource-room directors, and district resource professionals should obtain training in as many as possible of the potential uses of computers in instruction and administration.

Conclusion

Three questions posed at the outset pertained to the current instructional uses of computers, their demands on teachers and trainers of teachers, and the measures required to promote their use

further. Five distinct uses were identified: (1) Having the computer act as teacher in providing individualized tutoring or drill; (2) using the computer as an instructional aid to provide application opportunities through simulations or games; (3) teaching students about computers and their operation to a basic level of literacy for all and a more advanced level of competency for some; (4) promoting the ability to think through discovery, self-correction, and the combination of simple structures into more complex ones; and (5) helping teachers and administrators carry out essential management functions more efficiently than was previously possible.

If the full potential of computers is to be realized in education, institutions engaged in teacher education must assure that in their initial professional preparation prospective teachers become familiar with the potentialities and functioning of computers and develop the skills required for using them effectively in instruction and class management. Teachers inservice can learn much through self study and special district-sponsored workshops, but higher education institutions must make available graduate level courses in their certification and degree programs both to prepare computer specialists for schools and to enhance the level of computer competence of teachers in general. For the appropriate use of computers, schools must have specialists with the highest possible level of expertness, and all teachers need to acquire familiarity with available hardware, suitable computer languages, and commercially obtainable software, if not, indeed, learn to write programs themselves to their own specifications. In addition, they must be able to decide where and when to make use of programs in the curriculum, to diagnose individual learners' needs than can be met through the computer, and to apply perceptively the principles of developmental psychology and pedagogy based on exploration.

As their use of computers expands, school districts must develop and periodically review their policies and guidelines for such use, while continually enhancing teachers' sophistication with respect to computer functioning and utilization. The availability of computers is having a profound effect on education, challenging both those who operate schools and those who train educational personnel to see to it that they are employed both wisely and capably.

Glossary

Author languages: Computer languages that allow users to program without having much knowledge of computer languages.

Bit: Acronym for *bi*nary digi*t*. A bit, which is either 0 or 1, the smallest unit of digital information.

Bug: An error in a computer program.

Byte: A byte represents the number of bits required to store one character of text. Most current micro-computers use 8 bits per byte, although newer models may use 16 bits per byte.

Cathode ray tube (CRT): The most common display device for microcomputers. Either a standard TV or a monitor which is a modified TV.

Central processing unit (CPU): The logic ("brains") of a computer. It executes and interprets the commands from the user.

Chip: A small flat piece of silicon on which electronic circuits are inscribed.

Computer: An electronic device that manipulates symbolic information based upon instructions.

Computer System: The various components of a computer and peripheral devices that allow for communication and storage of information.

Floppy Disk Drive: A peripheral device for storing information. It utilizes a flexible plastic disk that has a magnetic recording surface.

Hardware: The physical devices that make up a computer system.

High level languages: Languages that use English-like commands to prepare programs for a computer. Examples are: FORTRAN, BASIC, COBAL, LOGO, APL.

Kilobyte (K): The number of bytes represented by two raised to the 10th power (2^{10}). This is exactly 1024, but is usually rounded to 1000. For example, a 48 K RAM machine would have approximately 48,000 bytes of RAM memory.

Microcomputer: A computer whose central processing unit is a microprocessor.

Microprocessor: A single integrated circuit that acts as the central processing unit.

Network: A communications connection between various peripheral devices or computers.

Random access memory (RAM): The memory in a computer that can be manipulated by the user through the central processor unit. The contents of this memory is lost when the machine is turned off.

Read only memory (ROM): Memory within the computer that has been fixed at the time of manufacture. This information can be read by the central processing unit but no new information can be written to it. Its contents do not disappear when the machine is turned off.

Software: The list of commands that tell the computer what functions to perform. These commands can be in various languages and do various tasks.

Wordprocessing: The utilization of a computer (often a microcomputer) to create, edit, store, and have printed textual materials.

18

BIBLIOGRAPHY

Books

Abelson, H. *LOGO for the Apple II.* New York: BYTE/McGraw Hill, 1982. The basic text for learning the Terrapin version of the LOGO Language with the Apple II computer.

Abelson, H. and diSessa, A. *Turtle Geometry.* Cambridge, MA: MIT Press, 1980. A detailed but rather high level (high school/college) discussion of ways to use LOGO-type languages in mathematics.

Bork, A. *Learning With Computers.* Bedford, MA: Digital Press, 1981. A discussion of Bork's work and his views on how computers should be used in the educational process.

Burke, R. *CAI Sourcebook.* Englewood Cliffs, NJ: Prentice-Hall, 1982. A how-to-do-it text on preparing CAI materials, mainly of the drill and practice and tutorial type.

Coburn, P. et. al. *Practical Guide to Computers in Education.* Reading, MA: Addison-Wesley, 1982. A good beginning text to help teachers understand some of the various ways computers might be used in their schools.

Elgarten, G., Posamentier, A., and Moresh, S. *Using Computers in Mathematics.* Reading, MA: Addison-Wesley, 1983. The book contains an outline for a one semester computer programming course as well as several ideas for programming projects in mathematics.

Goldberg, K. and Sherwood R. *Microcomputers: A Parent's Guide.* New York: Wiley, 1983. A beginning book for parents and teachers illustrating uses of computers in schools and homes.

Harper, D. and Stewart, J. (Eds.) *Run: Computer Education.* Belmont, CA: Brooks/Cole, 1982. A book with several articles by leaders in the field. Selected readings are quite good.

Heck, W., Johnson, J. and Kansky, R. *Guidelines for evaluating Computerized Instructional Materials.* Reston, VA: National Council of Teachers of Mathematics, 1981. A short book providing some guidelines on evaluating computer programs. A checksheet and rationale are discussed.

Logsdon, T. *Computers and Social Controversy.* Rockville, MD: Computer Science Press, 1980. The book describes the computer and discusses some of the possible societal implications.

Luehrman, A. and Peckham, H. *Computer Literacy: A Hands on Approach.* New York: McGraw-Hill, 1983. A computer literacy program for the Junior High School. Software is included as well as text.

Mathews, W. (Ed.) *Monster or Messiah? The Computers Impact On Society.* Jackson, MS: U. of Mississippi Press, 1980. Several authors present their views of benefits and problems of computer utilization.

Papert, S. *Mindstorms: Children, Computers, and Powerful Ideas.* New York: Basic Books, 1980. Papert's views on education in general and how the computer could be a powerful force in the future of education.

Seidel, R., Anderson, R. and Hunter, B. (Eds.) *Computer Literacy* New York: Academic Press, 1982. A report of a federally funded conference on computer literacy. Several major figures present their views.

Taylor, R. (Ed.) *The Computer in the School: Tutor, Tool, Tutee.* New York: Teachers College Press, 1980. Alternative viewpoints presented on the various roles of computers in the educational process.

Watt, D. *Learning With LOGO.* New York: McGraw-Hill, 1983. A book to help teachers use LOGO.

Journals

BYTE, P.O. Box 590, Martinsville, NJ 08826. A "hobbyists" journal that contains articles at a variety of levels. The August 1982 issue is totally on LOGO.

Classroom Computer News, International Education, 51 Spring Street, Watertown, MA 02172. An educational applications journal with some good articles/activities for students.

Compute! The Journal for Progressive Computing, 625 Fulton St., Greensboro, NC 27403. A general information magazine with occasional articles about educational applications.

The Computing Teacher, Dept. of Computer and Information Science, University of Oregon, Eugene, OR 97403. An educational applications journal with a variety of good articles and classroom ideas. The November 1982 issue is dedicated to LOGO.

Creative Computing, 39 E. Hanover Ave., Morris Plains, NJ 07950. A general applications journal with special issues of columns on education. A good source of hardware and software reviews.

Educational Computer Magazine, P.O. Box 535, Cupertino, CA 95015. A recent introduction to the educational applications field. Some useful articles.

Electronic Learning, 902 Sylvan Ave., Englewood Cliffs, NJ 07632. An excellent source of "how to" articles for education. Major software houses are advertisers.

InfoWorld, 375 Cochituate Rd., Box 880, Framingham, MA 01701. A newspaper-type publication which deals with the current changes in the R and D and marketing aspects of microcomputers.

The Journal of Computers in Mathematics and Science Teaching, P.O. Box 4455, Austin, TX 78765. The journal presents a mixture of research and classroom applications articles dealing with math/science use of microcomputers.

Popular Computing, P.O. Box 397, Hancock, NH 03449. A general educational journal with occasional articles on computer applications.

Selected Journal Articles

Anderson, C. "Teaching Computer Literacy: Guidelines for a Six-Week Course for Teachers." *Electronic Learning*, Nov./Dec. 1981, p. 30. An outline for a short course in computer literacy for novices.

Bitter, G. "Computer Literacy for Teacher Certification." *Educational Computer Magazine*, Jan./Feb., 1983, p. 22. The author presents components of Arizone State University's approach to teacher training for computer literacy.

Bork, A. "*Computers and Learning: Don't Teach BASIC.*" *Educational Technology*, April, 1982, p. 22. Dr. Bork's views on the problems with BASIC as a first computer language and some alternative suggestions.

Bracey, G. "What the Research Shows." *Electronic Learning*, Nov./Dec. 1982, p. 51. A synthesis of some major studies dealing mainly with computer assisted instruction (CAI). Positive overall effects are described on the basis of several studies.

Daiute, C. "Word Processing: Can It Make Even Good Writers Better?" *Electronic Learning*, Mar./April, 1982, p. 29. A presentation of some preliminary indications on the use of word processors with students and a review of some packages used in the classroom.

Underhill, R. et. al. "Microcomputers in Educational Settings: Data for Searches," *ERIC Clearinghouse for Science, Mathematics and Environmental Education*, Information Bulletin No. 3, 1982. An excellent source for ERIC, and CIJE references on microcomputer applications.

Kleiman, G., Humphrey, M. and Van Buskirk, T. "Evaluating Educational Software." *Creative Computing*, October, 1981, p. 84. Several aspects of software evaluation are presented and discussed with examples.

Luehrmann, A. *"Don't Feel Bad About Teaching BASIC." Electronic Learning*, September, 1982, p. 23. Luehrmann's response to critics of BASIC. Techniques for teaching BASIC in a more structured manner are presented.

Marks, G. "Computer Simulations in Science Teaching: An Introduction." *The Journal of Computers in Mathematics and Science Teaching*, Summer, 1982, p. 66. A continuing column about the application of LOGO to the classroom.

Papert, S. "Computers and Computer Cultures." *Creative Computing, March, 1981, p. 82. A summary of Papert's views on the utilization of computers in education.*

Ragan, A. "The Miracle Worker: How Computers Help Handicapped Students." Electronic Learning, Jan. - Feb., 1982, p. 57. The article outlines some of the ways computers have been used with handicapped students and possible directions for the future. Several references to various projects are supplied.

Toong, H. and Gupta, A. "Personal Computers." *Scientific American*, December, 1982, p. 86. An excellent beginning article for a wide variety of audiences. The article discusses hardware components and applications in a non-technical manner.

Williams, G. "Structured Programming and Structured Flowcharts," BYTE, March, 1981, p. 20. An article outlining the method of structured programming, especially as it applies to BASIC.

References

1. Market Data Retrieval, Inc. *Electronic Learning*, 2(4), January, 1983, p. 14.
2. Robert Taylor (ed.) *The Computer in the School: Tutor, Tool, Tutee*. New York: Teachers College Press, 1980.
3. Arthur Luehrmann, Computer Literacy, Inc.
4. Patrick Suppes. "The Uses of Computers in Education." *Scientific American*, 215(3), September, 1966, p. 206.
5. "Odell Lake," *Elementary Volume 4, Mathematics and Science*. Minnesota Educational Computer Consortium, St. Paul, Minn.
6. "Hurkle," Minnesota Educational Computer Consortium, St. Paul, Minn.
7. Seymour Papert, *Mindstorms: Children, Computers, and Powerful Ideas*. New York: Basic Books, 1980.

For complimentary single copies, or multiple copies at a nominal cost, write or call:

James J. Kiepper
Staff Consultant
Teacher Education Conference Board
159 Wolf Road
Box 15-008
Albany, New York 12212-5008
(518) 459-5400 (Ext. 643)

Position Papers published by the Teacher Education Conference Board:

1. *Teaching As A Profession: Toward The Promotion And Support Of Competence* — April, 1980
2. *The Effective Teacher* — October, 1981
3. *Teaching And Learning With Computers* — April, 1984